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ABSTRACT

Results are reported of a study to determine the influence of certain demographic variables on an individual's accuracy in cognitive mapping. Cognitive mapping refers to the way in which humans orient themselves in space through the use of imaginary maps of the physical world. Demographic variables measured were income, occupation, marital status, age, sex, and years in residence. The sample consisted of 148 volunteers from various civic, occupational, or residential groups in Muncie, Indiana. All subjects were 18 years of age or older. Participants viewed slides of intersections in the city and attempted to locate them on a map. Results indicate that high levels of occupation and income were found to be significantly powerful. Poorer, lower status individuals appear to live in a much less differentiated city. Responses of the youngest and oldest reflected less developed cognitive maps than middle-aged individuals. The conclusion is that an individual's cognitive map of his city is strongly influenced by the degree to which social roles permit interaction with the physical environment. Reduced participation of the poor, elderly, and young is an indication that such individuals, with inadequate cognitive maps, are at a disadvantage in utilizing available resources within their city. (Author/KC)

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# The View from Middletown: Demographic Variables Influencing Cognitive Mapping

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**Abstract**

The effect of several demographic variables on cognitive map accuracy was examined. Residents (n = 148) of a medium-sized, midwestern city were shown color photographs of 30 randomly selected intersections. Subjects were to identify the intersections by name and location; accuracy of identification constituted the dependent measure. A multiple regression analysis of six demographic variables on overall cognitive map accuracy showed that two of the variables, occupation and income, accounted for 55.8% of the total variance (Multiple R = .747). A comparison of the data with those obtained in larger cities is also made.

# The View from Middletown: Demographic Variables Influencing Cognitive Mapping

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Ten years ago Stea and Downs (1970) announced that the "image" was back in psychology. The particular image they referred to was nearly the same as the one first proposed by Trowbridge in 1913 who had argued that humans orient themselves in space through the use of "imaginary maps" (i.e., images) of the physical world. Fortunately, Stea and Downs were correct; in fact, a resurgence of interest in the general issue of cognitive imagery and representation is apparent in several subfields in psychology.

Research on "cognitive mapping," particularly within urban contexts, has been no exception to this general trend. As defined by Downs and Stea (1973), this term refers to a hypothetical process comprising a "series of psychological transformations by which an individual acquires, codes, stores, recalls, and decodes information about the relative locations and attributes of phenomena in his everyday environment (p. 9)." The product resulting from this process--a cognitive map--serves as a schematic framework used by the individual to organize physical movement within the environment and to interpret the meaning of its component elements.

Miller, Galanter, and Pribram (1960) in their general discussion of cognitive mediation have presented what must be considered the most

penetrating account to date of the relation of images to behavior. They note that images (i.e., cognitive maps) are a necessary but not sufficient condition for effective behavior whether spatial or otherwise. In addition to an internal representation of its environmental universe, an organism requires a "plan"--an hierarchical problem solving process--in order that behavior within that environment be effective and purposive. The present study will examine only the former of these components. However, it is worth noting that getting across town requires more than knowing where the other side is. Doing so requires both a representation of the town and a plan for how it is to be traversed.

An understanding of cognitive mapping and maps has great importance for geographers and urban designers as well as psychologists. Most recent work, particularly since the appearance of Lynch's (1960) influential book, has been concerned with examining how urban environments vary in perceptual clarity and complexity and also with how these characteristics affect the quality of urban cognitive maps. To date, several studies (e.g., de Jonge, 1960; Lynch, 1960; Milgram, 1972; Saarinen, 1969) have been conducted in cities such as Amsterdam, Boston, Chicago, Jersey City, Los Angeles, and New York.

Unfortunately, several problems present themselves in the literature on urban cognitive maps. First, the majority of measurement procedures used to date are sufficiently weak methodologically to preclude meaningful interpretation or comparison across cities. Although some highly

creative and rigorous strategies have been developed (e.g., Gould, 1966; Milgram, 1972), most studies have simply asked subjects to draw a map of the city and then tell the researcher about it. Apart from reinforcing the idea that cognitive maps are equivalent to cartographic maps, this procedure is prone to all the measurement errors inherent in any unstructured response measure. The lack of a common denominator in subjects' maps makes meaningful aggregation of individual responses extremely difficult. Finally, even the best procedures have been applied only to individual cities making inter-urban comparisons impossible.

A second category of problems concerns the type of cities which have been studied. Primarily, only major metropolitan areas have been examined. Empirical data concerning the cognitive maps of medium or small-sized cities is scarce. This is remarkable when one considers that cities and towns such as these offer a simplification of the stimulus field, making accurate interpretation of cognitive maps and the process through which they are formed more likely.

A third issue not adequately addressed by the current literature pertains to how characteristics of the individual influence the nature of the cognitive map formed. Even though the environment may exist in some "absolute" sense, individual representations of that environment are relative and unique. Each individual's particular history of environmental contact, interpretation, response, and reward necessarily prompts a set of perceptual images experienced only by that person. Thus, even though

cognitive maps of different individuals may be similar in general outline, they are dissimilar in specific detail.

Several recent studies are suggestive of how much these aspects of personal history influence individual cognitive maps. Orleans (1973), obtained strikingly different map sketches from poor and wealthy residents of Los Angeles. Maps from the poor portrayed a city of narrowly restricted neighborhoods extending only slightly beyond their neighborhood of residence. In contrast, the city of the affluent was highly differentiated and geographically dispersed. Likewise, Reginier (1976) and Ladd (1970) have suggested, respectively, there are important differences in the way the elderly and Black inner-city youths perceive their environment as compared to middle-aged Whites.

The present study seeks to address some of these concerns and offers empirical information regarding the influence of demographic variables on the accuracy of cognitive maps as compared to cartographic reality in a medium-sized, representative American city--Muncie, Indiana. Income, occupation, marital status, age, sex, and years in residence were tested against the hypothesis that they are statistically significant components of a multiple regression equation predicting cognitive map accuracy.

In addition, the study also examines the relative recognizability of different sites located within the city; this information allows the construction of several isoplethic maps. These maps indicate the topography of the image clarity offered by the city; some areas of the city are

easily recognized, while others are more difficult. Finally, the study also compares the cognitive map accuracy of residents of Muncie with those obtained in New York by Milgram (1972). As observed by Milgram (1972) the great difficulty in research on cognitive mapping lies in externalizing the unique cognitive representations held by individuals and then combining them into interpretable aggregated statements. A system must also be applicable in more than one locale and must be replicable across time within a given locale in order that its psychometric properties can be assessed and that inter-urban comparisons can be made. An adaptation of the procedure developed by Milgram was chosen for this study because of its potential for meeting these criteria and because its use would allow a direct comparison of cognitive maps obtained in Muncie with those he obtained earlier in New York City.

Milgram's cognitive mapping procedure is concerned primarily with identifying which sections of the city are most likely to be encoded in cognitive maps. To accomplish this, a sample of the city's intersections is taken using an objective, random strategy. Photographs of these intersections are then shown to subjects who are asked to identify their location. Subjects will be able to do so to the extent that certain requirements are met. First, the image presented by the city must be differentiable. A city comprised of homogenous and nondescript elements is more difficult to map than a visually uneven city consisting of highly "imageable" elements, to use Lynch's (1960) term. Second, the subject

must be able to match the photographed image with a private, previously learned image. The learning need not have taken place through personal experience. Cultural traditions, photographs, and maps may be employed to this end. The first photographs taken in orbit of the Earth were met with delighted sighs of recognition illustrating the effectiveness of these prior modes of image acquisition. Finally, subjects must be able to place a recognized image within its appropriate geographic context. An acquaintance who lived in New York once remarked that he knew Indiana was flat, full of corn, and wasn't it near Idaho? While he may have had an image of Indiana, he lacked a cognitive map of the Midwest.

## Method

Subjects and city. Residents of Muncie, Indiana, volunteered to serve anonymously as subjects (n = 148). Although resource limitations precluded obtaining a systematically representative or random sample, individuals from a broad range of socio-economic and occupational categories were included in the sample. All subjects belonged to various civic, occupational, or residential groups. Included were: church groups located on opposite sides of the city, a men's civic club, residents of a home for transients, a factory union, members of the fire department, college student groups, and employees of a charitable organization for children. All subjects were 18 years of age ($\overline{X}$ = 34.8) or older.

Muncie is a "medium-sized" (estimated population = 77,947; U.S. Census,

1979), midwestern city which has remained sociologically and visually representative of many American urban areas since first described by Lynd and Lynd (1929). As with most midwestern cities, it is surrounded by level farmland and small farm communities. Its economy is dominated by industries producing durable goods and farm related products and services. A large state university, regional hospital, and assorted retail and service industries are also major employers. Its physical elements reflect in form and function those expected in a culturally homogeneous city of its type and size. Lacking many of the monumental architectural components of larger cities, it tends visually to be a city of suburbs, a declining downtown, suburban shopping malls, factories, and a university area. Single-family housing predominates with the most expensive homes being located in the northwest section of the city. Transportation is effected primarily by private automobile.

Procedure. It was necessary to first divide the city into segments for use in subsequent analyses. Muncie lacks major political divisions used by residents of some cities to differentiate the image of their city (e.g., the boroughs of New York). However, two major east-west and north-south avenues are its approximate cartographic axes. Furthermore, residents use the east-west avenue as a "natural" dividing line defining the "North Side & South Side", both of which have stereotypical implications. Due to this correspondence in cognitive and cartographic maps, the city was divided as shown in Figure 1 into halves (North-South) and quadrants (NW -

NE - SW - SE) using these major north-south and east-west avenues.

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Insert Figure 1 about here

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Thirty street intersections within the city limits were next selected. To do so, an 11 X 11 grid was first overlaid onto a standard street map (Willis, 1977). Next, using a random number table, thirty grid intersections were chosen with the constraint that the distribution of the intersections be approximately equal in each of the four quadrants (n = 9, NW; 7, NE; 7, SW; 7, SE). Also, in order that all sites fall clearly within a quadrant, no intersections located on the axial avenues were included. The nearest street intersections to the grid intersections were then identified and color slides taken of each using a 35mm camera with a 50mm lens. In the event no named streets were near a grid intersection, the nearest identifiable building, park, or monument was photographed. Intersections were photographed in such a way that as much visual information as possible was included in each photograph; buildings, signs, businesses, or other elements which might be used to identify an intersection were included in the photograph. Street signs were, however, taped over.

In order for each site to fall clearly within a quadrant, it was necessary to exclude sites located in the "downtown" shopping-government area. This area is located at the intersection of the two axial avenues. Although this relatively important area of the city is thus underrepresented, its exclusion should in no way affect the analysis of demographic variables.

These photographs and a schematic map of the city (Figure 1) were shown to groups of subjects at a regularly scheduled meeting of their organization. In a brief introduction, subjects were told the general purpose of the study and were encouraged to answer as accurately as possible. The slides were then projected in random order for 30-45 seconds each. After viewing a photograph, a subject was to circle on a paper and pencil form which half (North - South) of the city in which it was located, next, to circle its quadrant (NW - NE - SW - SE) of location, and finally, to name the two streets which comprised the intersection. Subjects were asked to use the schematic map as a guide. Although no street names were shown on the map, subjects were told the names of the two axial avenues dividing the town. It was pointed out that no intersections were located on these avenues. Attached to the same response sheet were questions requesting information regarding the subject's age, sex (n = 112 male; 31 female; 5 no response), income, length of residence, occupation, marital status, and race. A respondent's occupation was later coded into one of nine general categories similar to those used by vocational analysts (Dictionary of Occupational Titles, 1977). The categories were: White-collar professional, White-collar managerial, White-collar technical, Blue-collar, Farming, Housewife, Other, Student, and Unemployed. Race and marital status were coded as White (n = 128) or Non-white (n = 2) and married or non-married. (See Table 2 for further information regarding demographic frequencies.)

Subjects received points for correctly identifying intersection locations according to the half, quadrant, and streets defining the site. One point was given for accurately naming the correct half, quadrant, and for each of the two streets defining an intersection. In the event a site was not located on a named street (e.g., within a large park), two points were given for correct identification of the site by name and one point for partial identification. Points received were summed, yielding a composite index of cognitive map accuracy for the entire city (ACCOV). In addition, separate indices were generated for identification by half (ACCH), quadrant (ACCQ), and site (ACCS) on the cartographic map.

## Results

Demographic Analysis. The results of four, linear multiple regression analyses are summarized in Table 1. In each analysis, nominal independent variables were defined using dummy variables. The six dummy variables for occupation included more than one of the original nine categories in order that sufficient numbers per category might be obtained. Because of its assumed importance and in order to preserve its identity, occupation was entered first into the regression equations using an hierarchical procedure. Other variables were subsequently entered in a step-wise manner. Due to insufficient non-white representatives, race was not included in the analysis.

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Insert Table 1 about here

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Regarding the summary measure of overall map accuracy (ACCOV), it is evident from inspection of Table 1 that occupation and income were by far the most important variables associated with accuracy. Occupation alone accounted for 51.4% of the variance (Multiple R = .717; $F$ (6,84) = 14.787, $p < .001$). When income was combined with occupation, the identified variance increased to 55.8% (Multiple R = .747). The addition of income allowed for a significant ($F$ (1,83) = 8.393, $p < .001$) reduction in residual variance. The relation between increasing levels of occupational status and income with overall accuracy was positive. Beta values for the dummy variables comprising occupation were all positive, except one. The range was from .599 (medium occupational status) to -.094 (low

occupational status); the highest two occupational status levels accounted for the second and third highest beta values. Beta for income was also positive (.248). No other variables significantly enhanced the prediction equation, although marital status approached significance ($p < .10$) as a predictor. The main effects for age, years in residence, and sex did not contribute importantly to criterion variance. Considering the analysis as a whole, the six variables produced a multiple correlation of .789 ($F$ (11, 79) = 11.832, $p < .001$) with ACCOV ($R^2 = .622$).

Information also presented in Table 1 for accuracy of location by city half (ACCH) and by city quadrant (ACCQ) demonstrates patterns of relationships which are highly similar to those obtained for ACCOV. Regarding ACCH and ACCQ, occupation again accounts for the majority of identified variance (22.3% and 40.0%, respectively). In both cases occupation's contribution is significant at the .001 level. For both ACCH and ACCQ the step-wise regression again called for income to be entered second in the equations; its contribution was significant for ACCQ ($F$ (1, 83) = 9.236, $p < .001$) but not so for ACCH ($p < .10$). However for ACCH age reaches significance ($F$ (1, 82) = 4.092, $p < .05$). Beta values for both the ACCH and ACCQ analyses were highly similar to those obtained in the ACCOV analysis.

A somewhat different pattern of relationships was obtained from the analysis involving accuracy of site identification (ACCS). Although occupation again accounts for the major portion of identified variance (Multiple R = .648), in this analysis income fails to obtain significance. The

addition of marital status, however, significantly reduces residual variance ($F$ (1,83) = 13.518, $p < .001$). When added, years in residence approaches significance ($p < .10$). The five variables entered into the equation for ACCS produce a multiple correlation of .833 and account for a sizeable portion of the variance (69.5%). The equation is statistically significant ($F$ (10,80) = 18.188, $p < .001$).

Table 1 also provides information regarding the relative, separate contributions of the individual predictor variables to obtained variance. The increases in $R^2$ shown in the table are the squared semi-partial correlations between a given predictor variable and criterion variable. Such measures are, of course, indicative of the contribution a particular independent variable makes to the identified variance, once the variance shared with other independent variables in the equation has been removed (Kerlinger & Pedhazur, 1973). These data are, however, relative and useful only within the context of a particular regression sequence. Caution must be used in their interpretation.

The influence of the variable "Occupation - D3" is apparent throughout the table. It alone contributes 40.2%, 12.1%, 25.7%, and 52.0% of the variance obtained with the respective criterion variables ACCOV, ACCH, ACCQ, and ACCS. While formally defined as "White-collar/technical", 12 of the 15 individuals whose occupations were so categorized were members of the Muncie Fire Department. (Residents should be pleased to learn that the single best predictor of cognitive map accuracy was whether an

individual was a fireman or not.) No other variables are as important as is this one. Note, however, that the contributions of segments of the variable occupation are equal to or greater than many other predictor variables taken as a whole. Occupation - D1 and D2 (White-collar/professional; White-collar/managerial, respectively) account for 2.3% and 3.4% of the variance for ACCOV. Likewise, Occupation - D4 (Blue-collar) accounts for 4.8% of the variance. This contrasts with Income which all together determines 4.5%. A similar pattern is observed for other criterion variables. Repeatedly, four occupational categories and income (with the exception of ACCS) determine the largest proportions of identified variance. The occupation categories D-5 and D-6 (Farming/Housewife/Other; Unemployed/Student, respectively) are also exceptions to this statement.

The effects of different levels of the predictor variables were examined through the application of several one-way analyses of variance. In those cases where significance ($p < .05$) was obtained, Duncan's Multiple Range Test was performed. These latter results are contained in Table 2.

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Insert Table 2 about here

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As expected, the effect of occupation was statistically significant across levels ($F$ (5, 110) = 15.441, $p < .001$) for the variable ACCOV. As shown in Table 2, White-collar technicians, professionals, and managers (D3, D1, D2) were significantly more accurate in their overall

accuracy (ACCOV) as compared to farmers, housewives, other occupations, students, and the unemployed (D5 & D6). Blue-collar workers were intermediate to these two assemblages of groups. Identical results were obtained for ACCQ and similar results were found for ACCH. The effect of varying occupations is perhaps clearest for ACCS--identification by site. Here, White-collar technicians (i.e., firemen) scored better than any other group. White-collar managers and professionals and Blue-collar workers were significantly less accurate. Farmers, housewives, and miscellaneous workers were less accurate yet. Students and the unemployed were the least accurate. There was considerable overlap in these lowest three groups.

Income, likewise, demonstrated significant effects across the six variables levels created for analysis in Table 2. The most parsimonious statement concerning the effect of income for all four criterion variables is that a positive, moderately curvilinear relation exists between income and map accuracy. The poorest group ($0-5000 yearly income) consistently obtained the worst scores. Individuals from middle income group ($10-15,000) obtained the highest scores, with the most affluent group ($25,000+) consistently scoring next highest in accuracy. The same relation was seen for other groups: as income increased, so did accuracy scores. Although income is positively correlated with increasing occupational status, this relation is not as great as might be expected; for ACCOV, the zero-order (Pearson r) correlation between these two

variables is only 0.1959.

The main effects of variables other than occupation and income were not found consistently to be predictive of cognitive map accuracy. However, given the exploratory nature of this study and the absence of cross-validation information for the predictive equations obtained, differences in effects between levels of these other variables were also examined. Several significant differences between variable levels were noted.

Regarding marital status, it was unexpectedly observed that married individuals ($n = 55$; $\bar{X} = 63.68$; $SD = 16.74$) obtained significantly higher overall scores ($F$ (1, 126) = 47.06, $p < .001$) than did non-married individuals ($n = 75$; $\bar{X} = 43.79$; $SD = 15.74$). This significant relation was also observed with ACCH, ACCQ, and ACCS serving as the dependent measures. No significant differences were observed for a second "non-predictive" variable, sex.

Significant differences were obtained between levels of two final and closely associated (zero-order $r = .6294$ for ACCOV) variables, age and years in residence. As shown in Table 2, age was arbitrarily divided into seven groups so that a one-way analysis of variance might be performed. Significant differences between these groups were observed for all dependent measures (for ACCOV, $F$ (6, 127) = 7.675, $p < .001$). Across these measures, the youngest and oldest groups

of subjects did not perform differently from one another, but were significantly below the level of more "middle-aged" groups. Allowing for some variation in the specific groups involved, this curvilinear effect of age was consistently observed for each dependent variable. Likewise, years in residence was also associated with significant between level effects for all dependent measures (for ACCOV, $F$ (4,116) = 11.059, $p < .001$). The effects of this variable are more difficult to summarize than those for age. Although for all measures the group of residents who had lived in the town 26 years or more performed better than any other, results for the other age groups allow no simple function to be extrapolated. For measures of "precise" identification (ACCQ & ACCS), the newest group (less than 2 years) performed the worst, while for a less precise measure (ACCH) their standing was better than residents of 6 to 25 years.

Topography of Site Identification. The relative recognizability of the 30 viewing sites is presented in Figures 2-4. Each of these isoplethic maps is a representation of the topography of the city's identifiability. Figure 2 is generated from the percentage of individuals who were able to correctly identify a site's location in the north or south half of the city. Figures 3 and 4 present similar information regarding placement by quadrant and by street. Responses from all subjects (n = 148) were pooled to obtain the percentages shown in these maps; non-responses were treated as incorrect responses. As shown, the

areas defined by isoplethic division refer to 0.0-24.9, 25.0-49.9, 50.0-74.9, 75.0-100.0 percent of correct identification by criterion. As is done in standard cartographic construction (Raisz, 1962) the isopleths connect points of equal value and are in proportionate distance from the viewing sites. As noted earlier, site sampling restrictions have likely caused the salience of the downtown area near the intersection of the two axial avenues to be underestimated in Figures 2-4.

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Insert Figures 2, 3, & 4 about here

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The most prominent feature of Figure 2 is a large swath of plus 50% identification accuracy running from NW to SE. The area included in this swath includes the university, recent housing developments, downtown, and a major avenue in the SE quadrant. The NW quadrant contains a disproportionate number of highly identifiable sites (plus 75%). Contained in this area are expensive homes, a major traffic intersection, and sites from around the university. Similarly, two major traffic intersections are highly identifiable in the SE quadrant. No other sites are as recognizable in the entire southern half of the city. The NE quadrant also contains an area of plus 75% recognizability centering around the city's major shopping mall. The importance of this site as a visual referent is underscored when it is observed that the point of least identifiability is located nearby in the same quadrant. The values comprising Figure 2

are possibly inflated due to the fact that a subject could guess and be right almost 50% of the time. However, the relative order of values is likely stable. Many of the features observed repeat themselves in Figures 3 and 4.

Figure 3 presents information on identification by quadrant. As with Figure 2, a large area of high recognizability (plus 50%) is observed in the NW quadrant. This area extends into the NE quadrant and lies approximately north of the river. Informal observation has also indicated that residents commonly perceive physical and socio-economic differences in areas lying "above or below the river." Apart from the downtown area, the region north of the river is, in general, more affluent, newer, and/or contains larger structures than south of the river. These characteristics have apparently been included in the residents' cognitive maps as criteria for differentiation. In addition, a site in this quadrant involving the university is recognized more than 75% of the time, once again underscoring the visual importance of the university area.

The two areas of plus 50% recognizability located in the SE quadrant include sites located on major commercial avenues. In the NE quadrant a shopping mall, a large park, and a site containing a sign advertising a well-known business establishment are relatively identifiable. It is noteworthy that in this figure large areas of the city are identifiable less than 50% of the time, with some areas being less than 25% recognizable.

Identification by site of location in the multiple regression

analyses involved awarding a score of 0, 1, or 2 depending on how accurate site identification was. Conceptually, either a score of 1 or 2 is a "correct" score. In order to produce a map of correct percentages, a dichotomy of correct (1 or 2) and non-correct (0) scores was imposed on these data. Hence, percentages of correct scores for Figure 4 are determined from rates of partial or complete site identification, whichever was higher.

The pattern of relationships portrayed in Figure 4 is similar, yet different from those in the preceding two figures. Figure 4 shows the university and shopping mall are, once again, highly identifiable (plus 50% and 75% respectively). A site in the upper NW quadrant (a university housing complex) and two sites in the upper SW quadrant (both located at important intersections) are also highly recognizable (plus 50%). The park in the NE quadrant, the commercial site in the SE, a university site in the NW, and a commercial site in the SW are also moderately identifiable (plus 25%). Curiously, the sites in the NW corner which were so consistently recognizable regarding location as to city half and quadrant in Figures 2 and 3 are now as unidentifiable as the rest of town. In fact, one is struck by the large areas of the city which elude identification by name or street. Many sites were previously shown to be recognizable by relatively gross criteria, viz., which part of town they were in. When asked to identify where a site was specifically located or by what name it was called, however, residents experienced considerable difficulty. They appeared to have a relatively good idea of where many sites were in general, but were

unable to precisely locate them.

Data presented in Table 3 describe the relative identifiability of the four quadrants in more detail and allow comparisons to be made with data obtained by Milgram (1972) in New York. These data were generated using calculations identical to his: percentages of correct responses for observation points were averaged for each quadrant. While Milgram analyzed his data according to identification by borough, neighborhood, and street location, the current data are presented by city half, quadrant, and site. Although these categories are not intended as equivalencies with Milgram's, they do allow some rough comparisons, especially according to street location.

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Insert Table 3 about here

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As seen in Table 3, the highest percent of correct identification (69.6%) was for intersections in the NW according to locations by city half. Although Muncie is approximately 100 times smaller in population than greater New York, this percent is only slightly higher than Milgram obtained in Manhattan for correct borough identification (64.1%). However, unlike the large differences Milgram obtained across boroughs (64.1% - Manhattan; 39.6% - Queens; 35.8% - Brooklyn; 26.0% - Staten Island; 26.0% - Bronx), differences found across quadrants for identification by city half were not great. Scenes randomly selected from the north or south half of Muncie are not much more or much less identifiable than are similar scenes

from Manhattan.

Muncie fares much better than New York in identification by quadrant. The highest score is again in the NW (60.6%) and the lowest is in the SW (35.1%). These compare (perhaps with a bit more conceptual fidelity) to scores for neighborhood in New York where the highest was in Manhattan (32.0%) and the lowest was in Staten Island (5.4%). Scores for Muncie fall considerably when street location is the criterion. However, they are still higher than in New York. Milgram observed correct street identification in Manhattan to be 15.5%; other boroughs were much lower (e.g., 2.8% - Brooklyn). The NW corner of Muncie was the most identifiable (27.0%), while the SE was least so (11.6%).

## Discussion

The data gathered in Muncie prompt several conclusions. Of initial interest are those concerning its characteristics as a physical referent for cognitive mapping.

The texture of Muncie's visual surface is highly uneven, although to a lesser degree than Milgram (1972) observed in New York. Two business areas, one in the SE and one in the NE, serve as points for orientation. The NW quadrant is the most visually legible of Muncie's areas, possessing relatively distinctive housing and a highly identifiable university area. The university and the large shopping mall are the two most important elements observed in the city. As suggested by Lynch's (1960) work, these areas appear to serve as the traffic nodes, identifiable districts, and

landmarks used to define the cognitive maps of Muncie's residents.

To its residents Muncie is approximately as cognitively mapable as Manhattan is to New Yorkers. When the disparity in the power of images evoked by the two cities is considered, this first appears puzzling. A city with the Empire State Building and the Statue of Liberty "should" be more legible than a city with shopping malls and fast-food chains. Size, however, intervenes. Muncie's residents are much more likely to have the opportunity to learn about their city in detail not possible for New Yorkers regardless of any graphic differentials between the two cities. Perhaps, then, the surprise is that New Yorkers know their city as well as they do; residents of Los Angeles--a large city, lacking the visual definition of New York--refer to their city as "formless" and "without centers" (Lynch, 1960). Similar, undefined sections of New York such as Queens and the Bronx are also very difficult to cognitively map (Milgram, 1972). The striking images presented by Manhattan may thus make it possible for New Yorkers to conceptually organize their environment with an accuracy rivaling that found in the cognitive maps of the much less complex environment of Muncie.

In addition to objective data regarding the characteristics of a representative, medium-sized city, the present study permits several conclusions regarding the influence of demographic variables related to the life history of individuals on the accuracy of their cognitive maps. As predicted, these variables were shown to be highly salient. The

multiple regression analysis which was performed--to my knowledge, unique in the literature--allows understanding of the relative importance of these variables. High levels of occupation and income were found to be particularly powerful, suggesting that individuals possessing wealth and occupational status have a greater opportunity and, possibly, necessity to learn about their city at geographically dispersed points than do poorer residents. Occupational demands such as these are particularly well illustrated by the relative ease with which firemen could make site identifications.

Secondly, poorer, lower status individuals appear to live in a much less well differentiated city than do higher status individuals. It is empirically clear that the former are restricted in their understanding of the city as a whole and may also be limited in their knowledge of the section in which they live.

The main effects of other demographic variables were not significant components of the equation predicting cognitive map accuracy. However, apart from sex, significant differences were obtained when levels of these variables were compared with each other. Married persons, who tended to have higher levels of income, status, age, and years in residence than single persons, were also better at identifying the city. Middle-aged residents did, as would be expected, better than younger groups. However, they also unexpectedly performed better than the oldest groups. Like the poor, responses of the youngest and oldest

respondents reflected much less well developed cognitive maps than middle-aged individuals. The present data likely underestimate this curvilinear relationship. No children or institutionalized elderly were included in the sample. Due to their limited contact with the city, groups such as these would probably have particularly ambiguous cognitive maps.

Although not a significant predictor of cognitive map accuracy, comparisons made across levels of years in residence suggest, even if speculatively, that cognitive maps may be acquired in two stages. The influence of time on these stages is different. The first stage seems to involve the relatively quick acquisition of a generalized map of the city. Although those residents who had lived in town longest uniformly had the most accurate maps, relatively new residents (3-5 years) performed nearly as well in identifying sites according to the general area in which they were located. However, when detailed specification of site location was requested, accuracy appeared to increase as a positive, monotonic function of years in residence. Thus, the second stage of map acquisition may involve the slow accumulation of detailed information about the city.

Further research is needed to explore these issues. The continued study of cities of varying size will allow a better understanding of this variable on cognitive maps. Attention should also be given to obtaining more systematic resident samples; if samples are large enough, the very important interactions of demographic variables may also be

examined. Although, as with any multiple regression analysis, the prediction equations obtained require cross-validation, this study indicates rather clearly that an individual's cognitive map of his city is strongly influenced by the degree to which various social roles permit or demand interaction with the physical environment. Individuals who are poor, elderly, young, or of low occupational status have been frequently described as marginal participants in the larger society. An additional consequence of this reduced participation appears to be a faulty or poorly defined image of the urban structures produced by that society. To the extent a lack of image clarity impairs purposive plans for behavior as argued by Miller, et al. (1960), individuals with inadequate cognitive maps should be at a disadvantage in utilizing available resources within their city. Furthermore, the lack of perceived control over life experiences and attendant depression often observed among socially marginal individuals (Seligman, 1975) may thus be exacerbated by inadequate cognitive maps.

Within the expanse of a "trackless" desert, the Bushmen of the Kalahari know where small clumps of edible vegetation are located. It is not surprising then that residents of a city possessing relatively few "imageable" elements should nonetheless have adequate cognitive maps. However, when it is observed that with the aid of such components residents of the greatly more complex environment of Manhattan are able to produce cognitive maps of similar accuracy, then a functional case

for attention to structuring eidetic clarity into a city can be made, apart from issues of aesthetics.

## Reference Note

1. Saarinen, T. F. Image of the Chicago Loop. Unpublished, University of Chicago, 1968.

## References

DeJonge, D. Images of urban areas: Their structure and psychological foundations. Journal of the American Institute of Planners, 1962, 28, 266-276.

Downs, R. M. & Stea, D. Cognitive maps and spatial behavior: Process and products. In R. M. Downs & D. Stea (Eds.), Image and environment. Chicago: Aldine, 1973.

Gould, P. R. On mental maps. Michigan Inter-University Community of Mathematical Geographics, Discussion Paper #9, 1966.

Kerlinger, F. N. & Pedhazur, E. J. Multiple regression in behavioral research. New York: Holt, Rinehart, and Winston, 1973.

Ladd, F. C. Black youths view their environment. Environment and Behavior, 1970, 2, 74-99.

Lynch, K. The image of the city. Cambridge, MA: MIT Press, 1960.

Lynd, R. S. & Lynd, H. M. Middletown: A study in modern American culture. New York: Harcourt, Brace, & World, 1929.

Milgram, S. A psycholcgical map of New York City. American Scientist, 1972, 60, 194-200.

Miller, G. A., Galanter E., & Pribram, K. H. Plans and the structure of behavior. New York: Holt, 1960.

Orleans, P. Differential cognition of urban residents: Effects of social scale on mapping. In R. M. Downs & D. Stea (Eds.), Image and environment. Chicago: Aldine, 1973.

Raisz, E. Principles of cartography. New York: McGraw-Hill, 1962.

Reginier, V. Neighborhoods as social systems. In M. Lawton, R. Newcomer, & T. Byerts (Eds.), Community planning for an aging society. New York: McGraw-Hill, 1976.

Seligman, M. E. P. Helplessness. San Francisco: W. H. Freeman, 1975.

Stea, D. & Downs, R. M. From the outside looking in at the inside looking out. Environment and Behavior, 1970, 2, 3-12.

Trowbridge, C. C. On fundamental methods of orientation and imaginary maps. Science, 1913, 38, 888-897.

U.S. Bureau of the Census. Current population reports: Population estimates and projections (Series P-25, #753). Washington, D.C.: U.S. Government Printing Office, 1979.

U.S. Department of Labor. Dictionary of occupational titles. Washington, D.C.: U.S. Government Printing Office, 1977.

Willis, J. H. Muncie, Indiana, and Delaware County (map). Muncie, IN: Hill Crest Publishing Co., 1977.

## Footnotes

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Table 1

Summary of Regression Analyses

| Predictor Variables | Multiple R | $R^2$ | $R^2$ Increase | Beta | F Ratio for Increase in $R^2$ |
|---|---|---|---|---|---|
| **Criterion Variable: Overall Map Accuracy (ACCOV)** | | | | | |
| Occupation - D1 | .151 | .023 | .023 | .3329 | |
| D2 | .237 | .056 | .034 | .3326 | |
| D3 | .677 | .459 | .402 | .5999 | |
| D4 | .712 | .507 | .048 | .1954 | |
| D5 | .712 | .508 | .000 | .0065 | |
| D6 | .716[a] | .514[a] | .006 | -.0942 | 14.787***[a] |
| Income | .747 | .558 | .045 | .2484 | 8.393*** |
| Marital Status | .760 | .578 | .019 | .2037 | 3.727 |
| Age | .780 | .608 | .030 | -.2949 | 6.257 |
| Years Residing | .786 | .618 | .011 | .1541 | 2.232 |
| Sex | .789 | .622 | .004 | .0680 | 0.799 |
| **Criterion Variable: Accuracy by City Half (ACCH)** | | | | | |
| Occupation - D1 | .139 | .019 | .019 | .3883 | |
| D2 | .204 | .042 | .022 | .4875 | |
| D3 | .404 | .163 | .121 | .5609 | |
| D4 | .465 | .216 | .053 | .7933 | |
| D5 | .471 | .222 | .006 | .4672 | |
| D6 | .473[a] | .223[a] | .001 | -.4417 | 4.027***[a] |
| Income | .505 | .255 | .032 | .2891 | 3.560 |
| Age | .539 | .291 | .035 | -.2855 | 4.092* |
| Sex | .551 | .304 | .014 | .1152 | 1.577 |
| Marital Status | .558 | .316 | .007 | .1120 | 0.843 |
| Years Residing | b | b | b | b | b |

Table 1 (continued)

| | | | | | |
|---|---|---|---|---|---|
| **Criterion Variable: Accuracy by Quadrant (ACCQ)** | | | | | |
| Occupation - D1 | .158 | .025 | .025 | .3461 | |
| D2 | .229 | .052 | .027 | .3305 | |
| D3 | .556 | .310 | .257 | .5113 | |
| D4 | .629 | .396 | .086 | .2820 | |
| D5 | .631 | .398 | .002 | .0330 | |
| D6 | .632[a] | .400[a] | .002 | -.1728 | 9.320***[a] |
| Income | .678 | .460 | .060 | .3359 | 9.236*** |
| Age | .694 | .482 | .022 | -.2959 | 3.535 |
| Marital Status | .710 | .505 | .023 | .1561 | 3.710 |
| Sex | .719 | .518 | .013 | .1247 | 2.110 |
| Years Residing | .722 | .521 | .003 | .0852 | 0.543 |
| **Criterion Variable: Accuracy by Site (ACCS)** | | | | | |
| Occupation - D1 | .120 | .015 | .015 | .2640 | |
| D2 | .210 | .044 | .029 | .2747 | |
| D3 | .751 | .564 | .520 | .6350 | |
| D4 | .762 | .580 | .016 | .0856 | |
| D5 | .762 | .580 | .000 | -.0168 | |
| D6 | .768[a] | .590[a] | .010 | -.0122 | 20.154***[a] |
| Marital Status | .805 | .648 | .057 | .2362 | 13.518*** |
| Years Residing | .815 | .664 | .016 | .2354 | 3.966 |
| Age | .829 | .687 | .023 | -.2334 | 6.049 |
| Income | .833 | .695 | .007 | .1278 | 1.937 |
| Sex | [b] | [b] | [b] | [b] | [b] |

*** $p < .001$
* $p < .05$
[a] Cumulative across dummy variables
[b] Calculation terminated; $F < .01$

Table 2

Summary of Duncan's Multiple Range Comparisons

Criterion Variable: Overall Map Accuracy (ACCOV)[a]

| Occupation | Groups* D3 | D1 | D2 | D4 | D6 | D5 |
|---|---|---|---|---|---|---|
| N | 14 | 21 | 11 | 3 | 56 | 11 |
| Mean | 75.43 | 60.29 | 60.18 | 59.00 | 41.61 | 41.45 |
| SD | 20.03 | 12.12 | 13.72 | 20.93 | 14.07 | 16.30 |

| Income | Groups* I3 ($10-15k) | I6 ($25+k) | I5 ($20-25k) | I4 ($15-20k) | I2 ($5-10k) | I1 ($0-5k) |
|---|---|---|---|---|---|---|
| N | 21 | 7 | 12 | 10 | 14 | 53 |
| Mean | 67.90 | 58.86 | 56.92 | 54.00 | 51.21 | 40.70 |
| SD | 17.80 | 11.17 | 17.70 | 15.48 | 18.51 | 13.62 |

| Age | Groups* A3 (31-40) | A4 (41-50) | A5 (51-60) | A2 (21-30) | A1 (0-20) | A7 (71+) | A6 (61-70) |
|---|---|---|---|---|---|---|---|
| N | 22 | 20 | 18 | 33 | 33 | 5 | 3 |
| Mean | 66.68 | 60.55 | 56.72 | 47.21 | 41.70 | 40.40 | 38.33 |
| SD | 16.57 | 13.54 | 20.44 | 17.70 | 13.83 | 11.37 | 13.05 |

| Years | Groups* Y5 (26-49) | Y4 (16-25) | Y2 (3-5) | Y3 (6-15) | Y1 (0-2) |
|---|---|---|---|---|---|
| N | 38 | 16 | 28 | 4 | 35 |
| Mean | 65.61 | 49.81 | 49.18 | 46.75 | 41.29 |
| SD | 16.48 | 19.55 | 14.88 | 24.24 | 13.88 |

Table 2 (continued)

Criterion Variable: Accuracy by City Half (ACCH)[a]

| Occupation | Groups* D4 | D3 | D2 | D1 | D6 | D5 |
|---|---|---|---|---|---|---|
| N | 3 | 15 | 11 | 21 | 56 | 12 |
| Mean | 23.33 | 21.87 | 21.82 | 21.62 | 17.55 | 15.42 |
| SD | 5.51 | 7.52 | 4.14 | 4.81 | 5.66 | 5.78 |

| Income | Groups* I3 ($10-15k) | I6 ($25+k) | I5 ($20-25k) | I4 ($15-20k) | I2 ($5-10k) | I1 ($0-5k) |
|---|---|---|---|---|---|---|
| N | 23 | 7 | 13 | 10 | 14 | 53 |
| Mean | 21.83 | 21.71 | 20.46 | 20.40 | 18.64 | 17.04 |
| SD | 6.15 | 3.35 | 5.62 | 5.56 | 6.49 | 5.64 |

| Age | Groups* A3 (31-40) | A4 (41-50) | A5 (51-60) | A2 (21-30) | A1 (0-20) | A6 (61-70) | A7 (71+) |
|---|---|---|---|---|---|---|---|
| N | 22 | 21 | 19 | 35 | 33 | 3 | 8 |
| Mean | 22.82 | 20.67 | 19.53 | 18.48 | 17.58 | 15.33 | 12.75 |
| SD | 4.27 | 6.34 | 6.89 | 5.93 | 5.56 | 3.21 | 7.63 |

| Years | Groups* Y5 (26-49) | Y2 (3-5) | Y1 (0-2) | Y4 (16-25) | Y3 (6-15) |
|---|---|---|---|---|---|
| N | 41 | 28 | 35 | 18 | 4 |
| Mean | 22.00 | 19.93 | 17.63 | 16.61 | 15.50 |
| SD | 5.34 | 5.24 | 5.64 | 6.63 | 10.41 |

Table 2 (continued)

Criterion Variable: Accuracy by Quadrant (ACCQ)[a]

| Occupation | Groups* D3 | D2 | D1 | D4 | D6 | D5 |
|---|---|---|---|---|---|---|
| N | 15 | 12 | 23 | 4 | 56 | 11 |
| Mean | 19.53 | 17.33 | 17.22 | 16.50 | 12.43 | 11.91 |
| SD | 6.13 | 4.36 | 3.27 | 8.58 | 4.88 | 5.36 |

| Income | Groups* I3 ($10-15k) | I6 ($25+k) | I5 ($20-25k) | I4 ($15-20k) | I2 ($5-10k) | I1 ($0-5k) |
|---|---|---|---|---|---|---|
| N | 23 | 8 | 15 | 10 | 15 | 53 |
| Mean | 18.48 | 16.75 | 16.40 | 15.40 | 13.67 | 12.21 |
| SD | 5.84 | 3.54 | 4.81 | 5.40 | 5.02 | 4.80 |

| Age | Groups* A3 (31-40) | A4 (41-50) | A5 (51-60) | A2 (21-30) | A1 (0-20) | A6 (61-70) | A7 (71+) |
|---|---|---|---|---|---|---|---|
| N | 24 | 22 | 19 | 35 | 33 | 3 | 9 |
| Mean | 18.21 | 16.86 | 16.47 | 13.43 | 12.70 | 12.33 | 11.56 |
| SD | 4.83 | 5.09 | 6.10 | 5.03 | 5.24 | 3.21 | 6.00 |

| Years | Groups* Y5 (26-49) | Y3 (6-15) | Y2 (3-5) | Y4 (16-25) | Y1 (0-2) |
|---|---|---|---|---|---|
| N | 42 | 4 | 28 | 18 | 37 |
| Mean | 18.00 | 15.00 | 14.39 | 14.11 | 12.84 |
| SD | 5.29 | 6.68 | 4.83 | 5.32 | 5.06 |

Table 2 (continued)

Criterion Variable: Accuracy by Site (ACCS)[a]

| Occupation | Groups* D3 | D2 | D1 | D4 | D5 | D6 |
|---|---|---|---|---|---|---|
| N | 14 | 12 | 23 | 4 | 12 | 56 |
| Mean | 32.29 | 21.08 | 20.26 | 20.00 | 13.75 | 11.63 |
| SD | 9.14 | 5.85 | 7.09 | 8.17 | 7.05 | 5.38 |

| Income | Groups* I3 ($10-15k) | I6 ($25+k) | I2 ($5-10k) | I5 ($20-25k) | I4 ($15-20k) | I1 ($0-5k) |
|---|---|---|---|---|---|---|
| N | 21 | 8 | 15 | 14 | 10 | 53 |
| Mean | 25.95 | 19.75 | 19.33 | 18.79 | 18.20 | 11.45 |
| SD | 10.47 | 4.53 | 8.79 | 8.60 | 6.76 | 5.03 |

| Age | Groups* A3 (31-40) | A4 (41-50) | A5 (51-60) | A2 (21-30) | A1 (0-20) | A7 (71+) | A6 (61-70) |
|---|---|---|---|---|---|---|---|
| N | 24 | 23 | 20 | 33 | 33 | 8 | 3 |
| Mean | 24.96 | 20.70 | 19.75 | 14.97 | 11.42 | 11.38 | 10.67 |
| SD | 9.31 | 7.70 | 9.56 | 8.86 | 4.77 | 7.98 | 7.09 |

| Years | Groups* Y5 (26-49) | Y4 (16-25) | Y3 (6-15) | Y2 (3-5) | Y1 (0-2) |
|---|---|---|---|---|---|
| N | 41 | 18 | 4 | 28 | 37 |
| Mean | 23.98 | 17.83 | 16.25 | 14.86 | 10.89 |
| SD | 8.65 | 10.82 | 8.18 | 6.69 | 5.21 |

*Groups underlined are significantly different from other groups at the .05 level.

[a]Non-responses account for variation in group size across criterion variables.

Table 3

Percentage of Correct Identification

According to Quadrant of Location

| Percent Correct for Location by: | Site Location | | | |
|---|---|---|---|---|
| | NW | NE | SW | SE |
| Half | 69.6 | 56.9 | 51.8 | 60.5 |
| Quadrant | 60.6 | 48.9 | 35.1 | 45.8 |
| Site[a] | 27.0 | 22.6 | 22.6 | 11.6 |

[a]Partial or complete identification

FIGURE 1 Schematic Map of Muncie

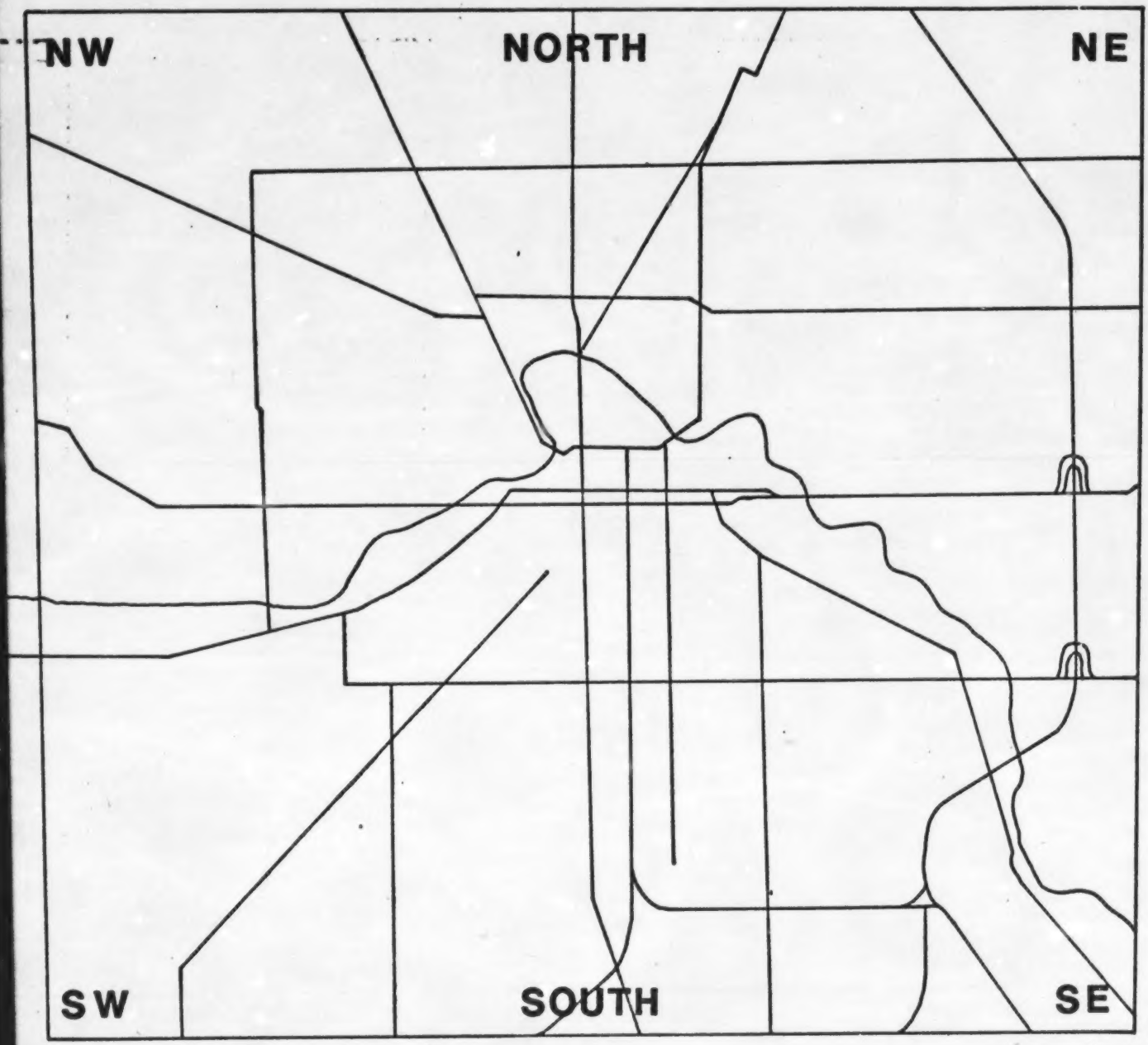

FIGURE 2 Percentage of Correct Site Identification by Location in North or South Half of City

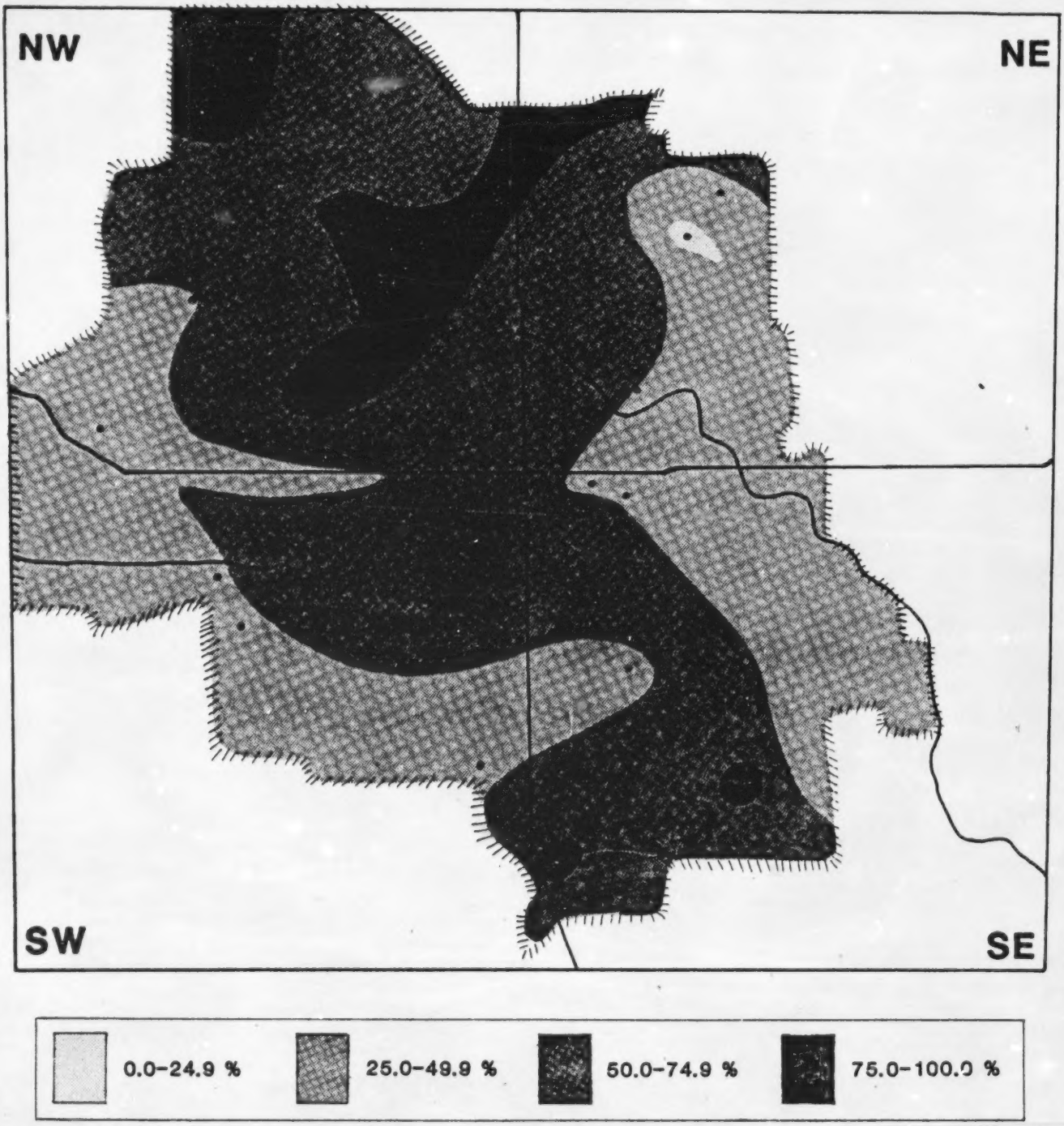

FIGURE 3 Percentage of Correct Site Identification by Quadrant of Location

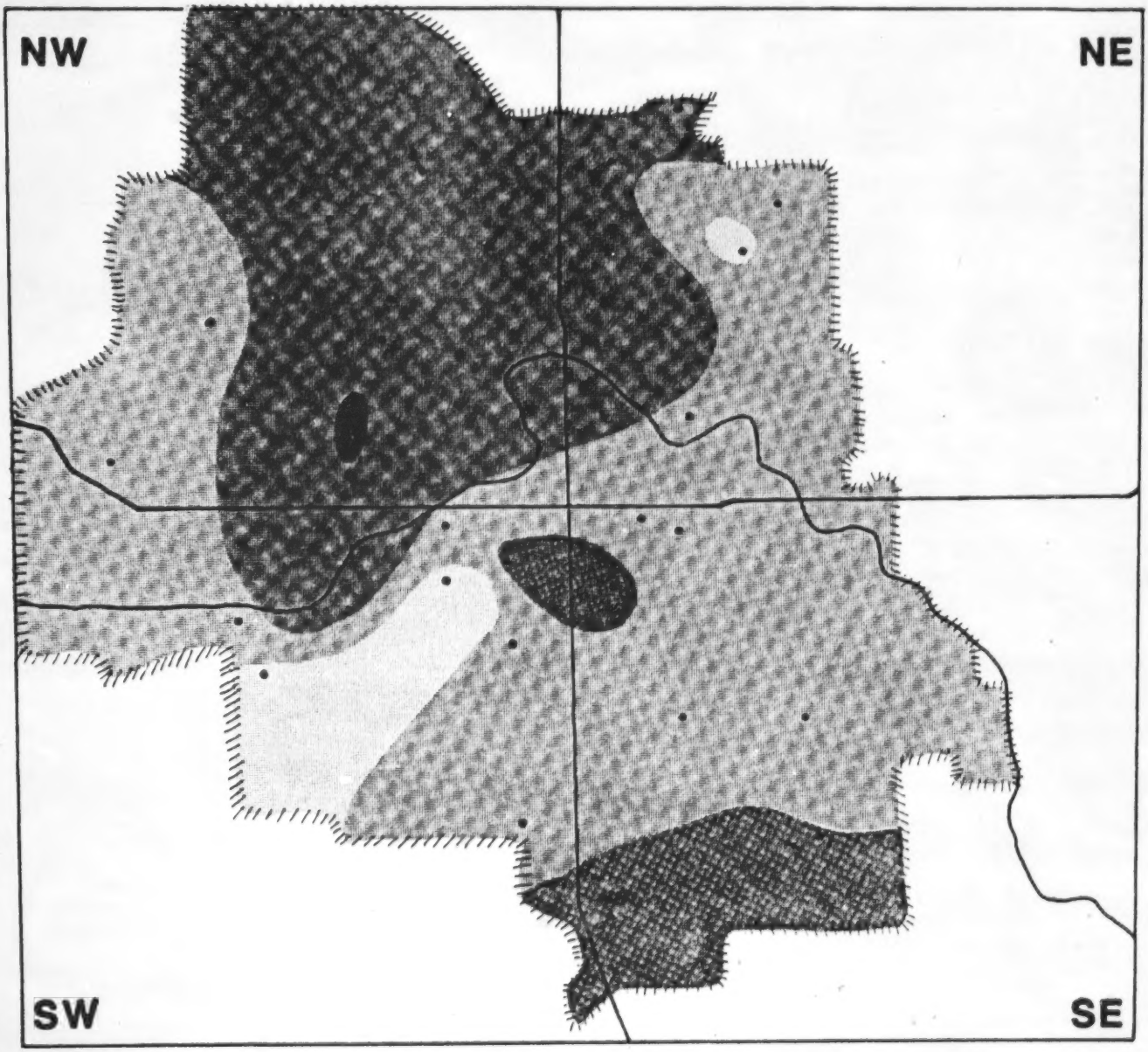

FIGURE 4 Percentage of Correct Site Identification by Street Location